Remote Investigation / Vehicle to Vehicle
Dynamic Science, Inc., Case Number (DS98021)
Colorado
October, 1997

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract

The case vehicle, a 1991 Dodge Dynasty driven by an 80-year-old male (168 cm/66 in., 64 kg /140 lbs.), was traveling southbound on a five-lane divided roadway. The case vehicle was in the left turn lane approaching a four-leg tri-colored light controlled intersection traveling at a police reported speed of 40 km/h (25 mph). The first other vehicle, a 1982 Volvo 240 GL driven by a 17-year-old male, was traveling southbound in the far right lane approaching the same intersection at a police reported speed of 64 km/h (40 mph). The second other vehicle, a 1987 Toyota Celica two-door driven by a 17-year-old male, was stopped in the eastern leg of the intersection waiting for the traffic signal to change. The right front seat was occupied by a 17-year-old male. As the Volvo entered the intersection, Vehicle 1 began a left hand turn. The driver of the Volvo saw the case vehicle and began braking---leaving 7.6 m (25 ft.) of locked wheel skids. This calculates to a minimum pre-braking travel speed of 36.8 km/h (22.9 mph). The right front of the case vehicle was struck by the front of the Volvo. The case vehicle sustained a longitudinal delta v of -11.5 km/h (-7.1 mph) and a lateral delta v of -13.7 km/h (-8.5 mph). The driver side air bag in the case vehicle deployed at this point. The case vehicle was pushed rearward into a counterclockwise rotation. The case vehicle entered the eastbound travel lanes and struck the front of the Toyota at a 45 degree angle after having traveled approximately 15.8 m (52 ft.). The driver of the Toyota saw the case vehicle coming toward his vehicle. He put the vehicle into reverse and had moved backwards approximately 0.30 m (1 ft.) before being struck. The driver of the case vehicle was found behind the wheel of his vehicle. There are multiple witness statements to the effect that he was not wearing his seatbelt at the time of the crash. He was found unconscious and unresponsive. He was transported to a local trauma hospital, arriving there at 1319 hours. Resuscitation was continued until 1322 hours when he was pronounced dead. The driver of the case vehicle was in apparent good health prior to the crash. According to the autopsy report, the driver of the case vehicle sustained a series of closed head injuries that included a scalp contusion, skull fractures, cerebral contusions, subarachnoid hemorrhage, subdural hemorrhage, and intra-ventricular hemorrhage; he also sustained a right clavicle fracture. At this point in time, it seems that the air bag caused the facial injuries, and the air bag may have pushed the head backwards or upwards into a hard interior surface. The case vehicle and the Volvo were towed from the scene due to damage. The Toyota was driven from the scene.

17. Key Words	18. Distribution Statement
Air bag, deployment, injury, accident, fatality, driver	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Dynamic Science, Inc.
Accident Investigation
Case Number: DS98021

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BACKGROUND:

Description:	This case is being initiated in response to a report of an air bag-related adult fatality. The NHTSA was notified via email in early to mid June. The initiator was the daughter of the deceased.
Investigation Type:	Remote
Crash Location:	Colorado
Crash Date:	October 1997
Notification Date:	July 30, 1998.
Field Work Completed:	NA

SUMMARY:

This three vehicle crash occurred at 1255 hours in October 1997 in the state of Colorado. The weather was clear and the roadway was dry and free of defects. The speed limit was 72 km/h (45 mph) for north/southbound traffic. The speed limit was 56 km/h (35 mph) for east/westbound traffic.

Figure 1. Exterior, case vehicle

The case vehicle , a 1991 Dodge Dynasty driven by an 80-year-old male (168 cm/66 in., 64 kg /140 lbs.), was traveling southbound on a five-lane divided roadway. The case vehicle was in the left turn lane approaching a four-leg tri-colored light controlled intersection traveling at a police reported speed of 40 km/h (25 mph). The first other vehicle, a 1982 Volvo 240 GL driven by a 17-year-old male, was traveling southbound in the far right lane approaching the same intersection at a police reported speed of 64 km/h (40 mph). The second other vehicle, a 1987 Toyota Celica two-door driven by a 17-year-old male, was stopped in the eastern leg of the intersection waiting for the traffic signal to change. The right front seat was occupied by a 17-year-old male. As the Volvo entered the intersection, the case vehicle began a left hand turn. The driver of the Volvo saw the case vehicle and began braking---leaving 7.6 m (25 ft.) of locked

wheel skids. This calculates to a minimum pre-braking travel speed of 36.8 km/h (22.9 mph). The right front of the case vehicle was struck by the front of the Volvo. The case vehicle sustained a longitudinal delta v of -11.5 km/h (-7.1 mph) and a lateral delta v of -13.7 km/h (-8.5 mph)[1]. The driver's air bag in the case vehicle deployed at this point. The case vehicle was pushed rearward into a counterclockwise rotation. The case vehicle entered the eastbound travel lanes and struck the front of the Toyota at a 45 degree angle after having traveled approximately 15.8 m (52 ft.). The driver of the Toyota saw the case vehicle coming toward his vehicle. He put the vehicle into reverse and had moved backwards approximately 0.30 m (1 ft.) before being struck.

Figure 2. Interior, case vehicle

The driver of the case vehicle was found behind the wheel of his vehicle. There are multiple witness statements to the effect that he was not wearing his seatbelt at the time of the crash. He was found unconscious and unresponsive. He was transported to a local trauma hospital, arriving there at 1319 hours. Resuscitation was continued until 1322 hours when he was pronounced dead.

The driver of the case vehicle was in apparent good health prior to the crash.

According to the autopsy report, the driver of the case vehicle sustained a series of closed head injuries that included a scalp contusion, skull fractures, cerebral contusions, subarachnoid hemorrhage, subdural hemorrhage, and intra-ventricular hemorrhage; he also sustained a right clavicle fracture. At this point in time, it seems that the air bag caused the facial injuries, and the air bag may have pushed the head backwards or upwards into a hard interior surface.

The case vehicle and the Volvo were towed from the scene due to damage. The Toyota was driven from the scene.

[1]Calculated using WinSMASH missing vehicle run with an estimated crush profile for the case vehicle.

Scene Diagram

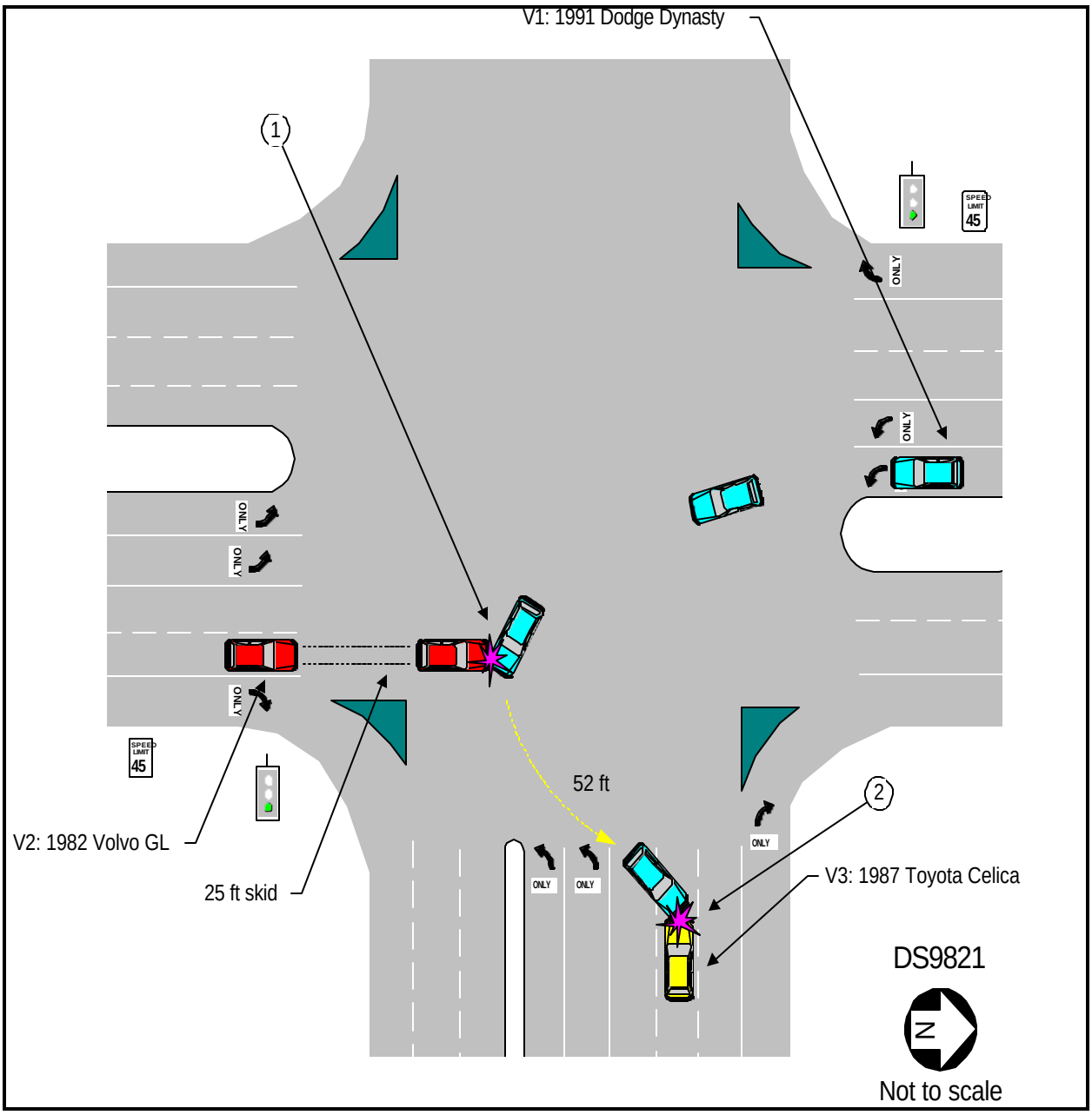

Figure 3. Scene diagram

DETAILED INFORMATION

Vehicles

Case vehicle

Description:	1991 Dodge Dynasty	
VIN:	1B3XC46R9MDxxxxxx	
Odometer:	Unknown	
Engine:	3.3l 6 CYL EFI	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Moderate damage to the right front fender and wheel area.	
CDC:	02RYEW3	
Delta V[2]:	Total	17.9 km/h (11.1 mph)
	Longitudinal	-11.5 km/h (-7.1 mph)
	Latitudinal	-13.7 km/h (-8.5 mph)
	Energy	27,552 joules (20,338 ft-lbs)

Vehicle 1 was equipped with a single, driver-side air bag. There are two crash sensors, one located behind each of the front fender wells. The air bag control module is located in the lower center instrument panel.

[2]Borderline reconstruction–results not encoded on data forms.

Figure 4. Case vehicle, Exterior

Figure 5. Case vehicle, Exterior

Other vehicle

Description:	1982 Volvo 240 GL 2-door	
VIN:	YV1AX4522Bxxxxxx	
Odometer:	Unknown	
Engine:	B21F	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	According to the police report, there was heavy damage to the front and the right fender.	
CDC:	Unknown	
Delta V:	Total	18.1 km/h (11.2 mph)
	Longitudinal	-17.8 km/h (-11.1 mph)
	Latitudinal	3.1 km/h (2.0 mph)
	Energy	14,049 joules (10,371 ft-lbs)

Other vehicle

Description:	1987 Toyota Celica GT-S	
VIN:	JT2ST65C1Hxxxxxx	
Odometer:	Unknown	
Engine:	4 cyl	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Police report indicates moderate damage to front end.	
CDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Occupants

Case vehicle	Occupant 1
Age/Sex:	80/Male
Seated Position:	Left front
Seat Type:	Bucket
Height:	168 cm (66 in.)
Weight:	64 kg (140 lbs.)
Occupation:	Retired
Pre-existing Medical Condition:	Cerebral atrophy, mild to moderate
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Right presumed to be on accelerator
Restraint Usage:	None used
Air bag:	Driver's side air bag deployed

Other vehicle (Volvo)

Age/Sex:	17/Male
Seated Position:	Left front
Seat Type:	Unknown
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	Unknown
Alcohol/Drug Involvement:	None
Driving Experience:	Approx. 1 year
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Right presumed to be on brake
Restraint Usage:	Unknown

Other vehicle (Toyota)	Occupant 1	Occupant 2
Age/Sex:	17/Male	17/Male
Seated Position:	Left front	Right front
Seat Type:	Unknown	Unknown
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	Unknown	Unknown
Alcohol/Drug Involvement:	Unknown	Unknown
Driving Experience:	Approx. 1 year	NA
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Right presumed to be on accelerator as driver attempts to back up	Unknown
Restraint Usage:	Restraint used, type unknown	Restraint used, type unknown

Injuries and Injury Mechanisms

	INJURY	OIC CODE	ICD-9	SOURCE
Case vehicle				
Driver:	Contusion, under and lateral aspects of the temperoparietal and occipital areas of the left cerebral hemisphere	140604.3,3	851.06	Possibly roof and/or B-pillar
	Fracture, extension of posterior fracture laterally and then inward to involve both the temporal fossa and the sphenoid bone	150200.3,8	801.2	Possibly roof and/or B-pillar
	"L" shaped fracture right posterior surface of skull	150400.2,1	800.2	Possibly roof and/or B-pillar
	35 cc subdural hemorrhage	140438.4,6	NA	Possibly roof and/or B-pillar
	Bilateral subarachnoid hemorrhage	140466.3,6	NA	Possibly roof and/or B-pillar
	Fracture, right clavicle	752200.2,1	810.0	Air bag
	Large area of contusion involving right lateral posterior and upper portions of the head	190402.1,1	920.0	Possibly roof and/or B-pillar
	Laceration, right ear	290600.1,1	872.0	Side glass (flying)
	Contusion, left upper eyelid	297402.1,2	921.1	Air bag
	Contusion, nose	290402.1,4	920.0	Air bag
	Abrasion, chin	290202.1,8	920.0	Air bag
	Ecchymoses, lateral aspect, both forearms	790402.1,1 790402.1,2	923.10 923.10	Air bag
	Laceration, tip of middle finger	790600.1,2	883.0	Side glass (flying)
	Abrasion, left knee	890202.1,2	916.0	IP
	Abrasion, lower leg	890202.1,2	916.0	IP

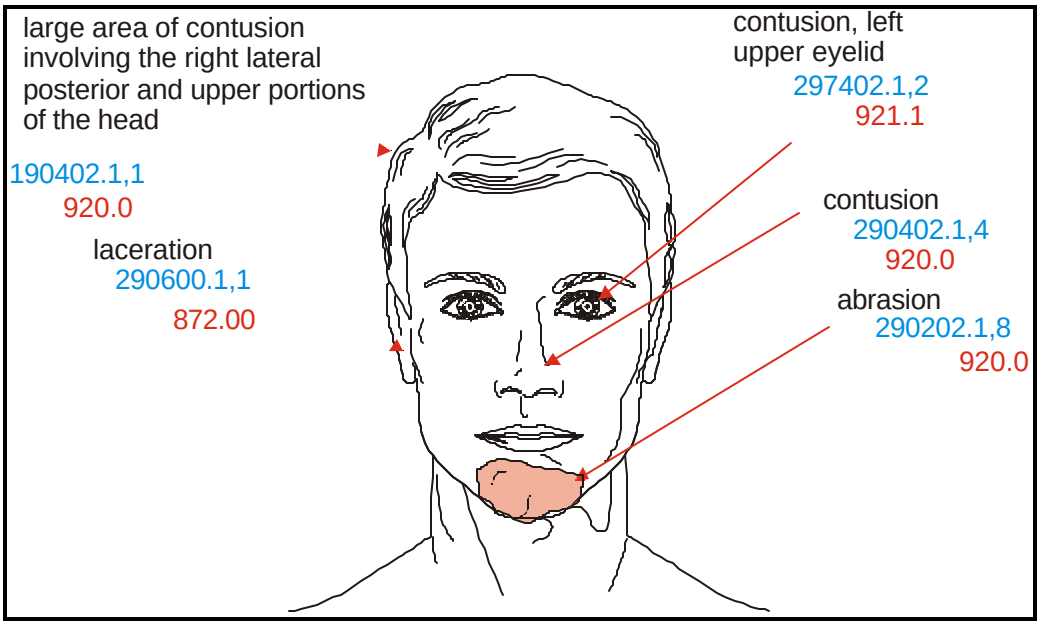

Figure 6. Facial injuries, driver, case vehicle

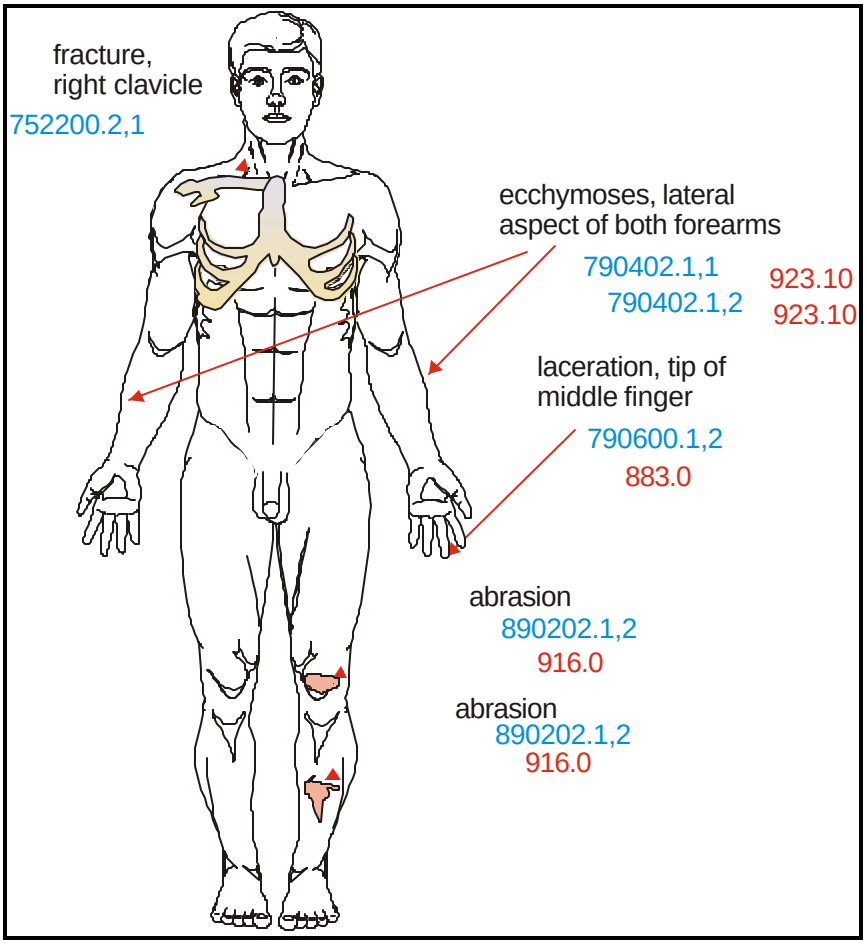

Figure 7. Soft tissue injuries, driver, case vehicle

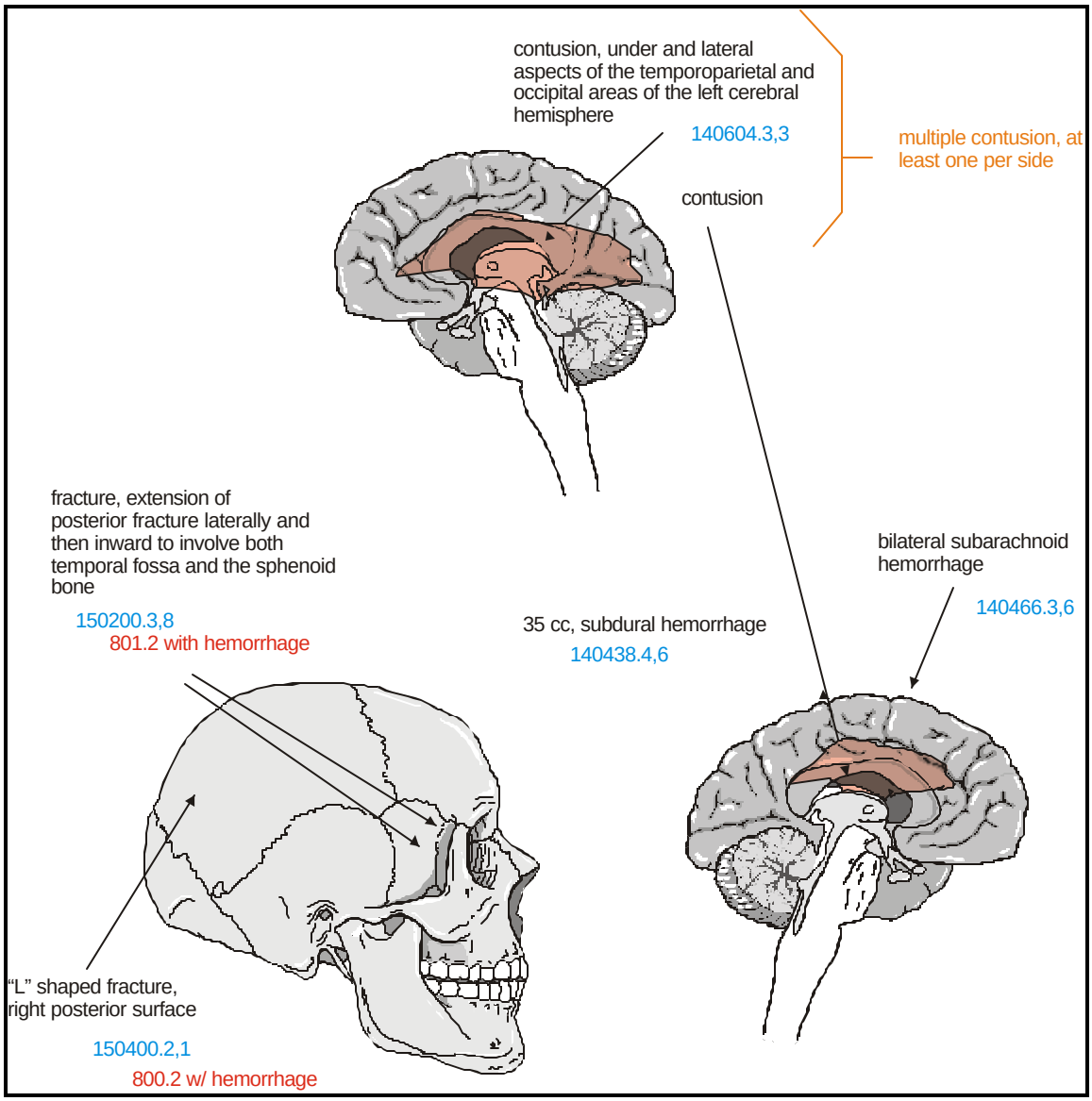

Figure 8. Skull/brain injuries, driver, case vehicle

	INJURY	OIC CODE	ICD-9	SOURCE
Other vehicle (Volvo)				
Driver:	Closed head injury	160499.1,O	850.9	Unknown
Other vehicle (Toyota)				
Driver:	Not injured			
RF occupant:	Not injured			

Occupant Kinematics

The driver of the case vehicle was likely seated upright in a normal position. It is this investigator's opinion that he had both hands on the steering wheel. He was not wearing the available lap and shoulder belt. The case vehicle was in the midst of a left-hand turning maneuver. At some point in this turn, the driver of the Volvo began braking. The driver of the case vehicle likely looked toward his right upon hearing the braking sounds. At impact, the driver moved forward and to the right, bringing his left knee and lower leg into contact with the instrument panel. The air bag deployed at this point, striking the driver fully in the face; this caused the contusion to the eye and nose and the abrasion to the chin. As the air bag deployed laterally, both lower arms were contacted and sustained contusions. The right side window disintegrated and the flying glass appears to have caused the right side finger and ear lacerations. The deploying air bag forced the driver's head upward and possibly to the left. It appears likely that the rear/top of the driver's head struck either the roof or possibly the B-pillar, causing the skull fractures and resultant brain injuries.